

July 8, 2015

$\sqrt{\frac{54}{12}}$

① Simplify fraction first

$$\sqrt{\frac{9}{2}} = \frac{\sqrt{9}}{\sqrt{2}} = \frac{3}{\sqrt{2}}$$

$$\frac{9}{2} \cdot \frac{1}{1} = \frac{54}{12}$$

$$= \frac{1 \cdot 3 \cdot 1 \cdot 3}{2}$$

②

$$\frac{\sqrt{54}}{\sqrt{12}} = \frac{\sqrt{3 \cdot 18}}{\sqrt{3 \cdot 4}} = \frac{\sqrt{3} \cdot \sqrt{18}}{\sqrt{3} \cdot \sqrt{4}}$$

$$= \frac{\sqrt{18}}{\sqrt{4}}$$

$$= \frac{\sqrt{2 \cdot 9}}{\sqrt{2 \cdot 2}}$$

$$= \frac{\sqrt{2} \cdot 3}{2}$$

$$= \frac{3\sqrt{2}}{2}$$

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$\frac{3}{\sqrt{2}}$ → Rationalize the Denominator

There is a Practice of not moving radicals in the denominator

$$\frac{3}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{3\sqrt{2}}{\sqrt{2 \cdot 2}}$$

Multiplicd by itself

$$= \frac{3\sqrt{2}}{\sqrt{4}}$$

$$= \frac{3\sqrt{2}}{2}$$

↑ NOW Rationalized

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$$\frac{10}{\sqrt{13}} \cdot \frac{\sqrt{13}}{\sqrt{13}} = \frac{10\sqrt{13}}{\sqrt{13 \cdot 13}}$$

$$= \frac{10\sqrt{13}}{\sqrt{169}} = \frac{10\sqrt{13}}{13}$$

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$$\frac{2}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{2\sqrt{2}}{\sqrt{4}}$$

$$= \frac{2\sqrt{2}}{2}$$

$$= \sqrt{2}$$

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Operations on Radicals

① multiplication

$$\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$$

* because we have the same index

a.) $\sqrt{3} \cdot \sqrt{5} = \sqrt{3 \cdot 5} = \sqrt{15}$

b.) $\sqrt{12} = \sqrt{3 \cdot 4} = \sqrt{3} \cdot \sqrt{4} = 2\sqrt{3}$

② Division

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

* again, because indices are the same.

a.) $\frac{\sqrt{75}}{\sqrt{3}} = \sqrt{\frac{75}{3}}$

$$= \sqrt{25} = 5$$

b.) $\frac{\sqrt{3 \cdot 25}}{\sqrt{3}} = \frac{\sqrt{3} \cdot \sqrt{25}}{\sqrt{3}} = 5$

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Addition (Subtraction)

Key Idea: We can only add "Like" Radicals!

Like Radicals

- ① Same Radicand
- ② Same Index

e.g.

$$3\sqrt{5} + 7\sqrt{5}$$

Coefficients of $\sqrt{5}$ are added

$$(3+7)\sqrt{5} = 10\sqrt{5}$$

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$$2\sqrt{11} - 15\sqrt{11}$$

$$(2 + (-15))\sqrt{11}$$

$$-13\sqrt{11}$$

$$(-2)\sqrt{11} - 15\sqrt{11}$$

$$(-2 + (-15))\sqrt{11}$$

same "sign"

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$$\sqrt{45} + \sqrt{12}$$

* Radicands are not the same!
But Indexes are same.

$$\sqrt{9 \cdot 5} + \sqrt{4 \cdot 3}$$

$$\sqrt{9} \cdot \sqrt{5} + \sqrt{4} \cdot \sqrt{3}$$

$$3\sqrt{5} + 2\sqrt{3}$$

* Simplify, but not add!

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Properties of Algebra

$$2 + 3 = 5$$

$$x + y = x + y$$

Closure \rightarrow i.e. is an operation closed or open?

Natural Numbers = $\{1, 2, 3, \dots\}$

* Is addition closed?

$$3 + 1 = 4$$

Is this natur? Yes!

Rational Numbers

$$\frac{1}{2} + \frac{1}{2} = \frac{1+1}{2} = \frac{2}{2} = 1$$

addition open natur?

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Algebra's Power Tools

(See Handout)

- Commutative Prop of $+$ & \times

$$a + b = b + a$$

- We can change the order, but get the same result.

$$2 + 3 = 3 + 2$$

$$5 = 5$$

$$3 - 2 \neq 2 - 3$$

$$1 \neq -1$$

Subtraction does not apply

* But

$$3 + (-2) = (-2) + 3$$

$$1 = 1$$

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- Associative Prop of $+$ & \times

$$a + (b + c) = (a + b) + c$$

associated associated

$$2 + (3 + 4) = (2 + 3) + 4$$

$$2 + 7 = 5 + 4$$

$$9 = 9$$

- Order stays the same, but association changes but the result is the same.

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1, 3, 4, 6, 7, 11, 14, 17, 19, 22, 23, 24, 26, 29, 31, 32, 35, 38, 41, 51, 52, 59-68

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